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AGROTECHNOLOGY AND FOOD RESOURCES

No. 4

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USSR REPORT  
LIFE SCIENCES  
AGROTECHNOLOGY AND FOOD RESOURCES

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## NEW LEGUME FERTILIZER SUCCESSFUL

Minsk SOVETSKAYA BELORUSSIYA in Russian 21 Feb 80 p 2

[Article by Belorussian SSR Academy of Sciences Corresponding Member V. Nesterenko, Candidate of Technical Sciences V. Borisevich and Correspondent A. Litvin: "The Rhizoturfene Reserves"]

[Text] Animal husbandry is a major sector of the national economy. Much has been done in our country to develop it further. In the last few years many livestock farms and complexes outfitted with the latest equipment have been built. However, as Comrade Leonid Il'ich Brezhnev pointed out at the November (1979) Plenum of the CPSU Central Committee, the return from this sector is still small, and the production of meat and other livestock products is growing too slowly. One of the reasons for this slowness lies in the protein imbalance of feed. This means that we must increase the production of complete feed everywhere to the greatest extent possible.

We can commend those farms that intend to expand their legume fields this spring in order to provide more raw material in the fall for food and chemical industry, and mainly to increase procurement of protein-rich feed for public animal husbandry. As we know, the legumes--soy, peas, beans, lentils, lupine, alfalfa, and others--are highly superior to cereals in protein content. While grain from cereal crops contains 12-15 percent protein, legumes contain up to 20-40 percent, while soy and lupine contain as much as 50 percent.

The main factor influencing the yield and the protein content is, first of all, the nitrogen nutrition afforded to the plants. Legumes possess a unique property--they are capable of assimilating atmospheric nitrogen in symbiosis with nodular bacteria. The fight for a high legume yield must begin with the seeds, with treating the planting material with a new bacterial fertilizer--rhizoturfene. And then, when we combine this with the conventional, traditional methods of field care, we would insure a significant increment to the legume yield.



Scientists of the Belorussian SSR Academy of Sciences Institute of Nuclear Power Engineering, working together with their colleagues from All-Union scientific research institutes of agricultural microbiology and bacterial preparations, the Belgiprobiosintez (not further identified), and the Belorussian SSR Scientific Research Institute of Soil Science and Agrochemistry in collaboration with the collectives of the Nesvizh Biomycin Feed Plant and the Nesvizh Production Association (the principal organization for this problem), developed the processes for producing a new bacterial fertilizer containing nitrogen-assimilating bacteria--rhizoturfene. The production process makes use of a radiation method of sterilization. The results of such developments have been extremely encouraging.

What is this miraculous preparation? Rhizoturfene is obtained by inoculating useful microorganisms into a nutrient medium consisting mainly of peat. But peat possesses a rich natural microflora, which suppresses development of useful microorganisms inoculated into it. Therefore it must be sterilized. The thermal peat sterilization method suggested earlier turned out to be technologically complex and laborious. Moreover toxins that retard development of nodular bacteria appear in peat following its thermal processing. The collective of the Belorussian SSR Academy of Sciences Institute of Nuclear Power Engineering, together with other participants of the scientific research, suggested a radiation method of nutrient medium sterilization.

As we know, radiation sterilization of various medical articles has already been employed for a long time in the industry of our country and abroad. Its important advantage is that it does not require high temperatures. This is the decisive factor of processing substances that are not heat resistant, such as, for example, organic substances. Sterilization is performed with gamma-rays--that is, electromagnetic radiation similar to x-rays. Materials sterilized by this method are absolutely safe to use. Another important fact is that we can sterilize materials contained within sealed packages, for example in polyethylene bags.

As many studies and experiments have shown, gamma-radiation annihilates peat microflora and makes it possible to obtain high quality rhizoturfene devoid of incidental microorganisms. Moreover the radiation method for producing bacterial fertilizer was found to be less laborious than the thermal method. The new preparation is highly superior to the best foreign fertilizers of similar type in relation to the concentration of useful microorganisms. Just 200 grams of rhizoturfene suffices to process enough legume seeds to plant an area of 1 hectare.

Using processes developed with the participation of the collective of the Belorussian SSR Academy of Sciences Institute of Nuclear Power Engineering, our country is presently producing rhizoturfene at the Leningrad Experimental-Production Enterprise of the All-Union Scientific Research Institute of Agricultural Microbiology, the Nesvizh Feed Biomycin Plant in the Belorussian SSR, and the Kiev Bacterial Preparation Plant in the Ukrainian SSR. The bulk of our rhizoturfene is produced with the application of radiation sterilization

at the gamma-radiation facility of the Belorussian SSR Academy of Sciences Institute of Nuclear Power Engineering. In 1976-1979 the collectives of these enterprises produced enough rhizoturfene to process more than 680,000 hectares worth of seeds. The compound was used at a number of farms of the RFSFR, Kazakh SSR, Ukrainian SSR, Belorussian SSR, Armenian SSR, Bashkir ASSR, and Chuvash ASSR. In Belorussia, for example, this preparation is applied to peas and lupine, as well as alfalfa and clover. These crops produced an additional yield of 16-37 percent from every planted hectare with the help of this fertilizer.

Interesting results were obtained at the Rodina Kolkhoz, Nesvizhskiy Rayon. Alfalfa processed with rhizoturfene was planted in 1978 in strips alternating with alfalfa (for comparison) not processed by this preparation. By the end of 1978 the root system of stems treated with rhizoturfene developed significantly better than did stems in neighboring strips, penetrating into the soil to a great depth. As we know, there were no rains for a long time at the beginning of summer 1979. Alfalfa not processed with rhizoturfene lacked moisture, and the plants developed slowly, while alfalfa treated with rhizoturfene grew excellently, and by June it significantly outgrew the untreated plants. The average yield increment resulting from rhizoturfene application, determined from the total of three harvests, was 37 percent on this field.

Owing to the use of rhizoturfene for presowing seed treatment, an additional 251,000 centners of soy were obtained just last year alone (within the surveyed area) in the Kazakh SSR, the Ukrainian SSR, Amurskaya and Rostovskaya oblasts, and Stavropol'skiy and Krasnodarskiy krays, while the added yield of this valuable crop averaged 2.7 centners per hectare.

Experts have estimated that the economic impact from introducing rhizoturfene as a stimulator in soy cultivation, using the radiation method of substrate sterilization, exceeded 6 million rubles in our country in 1976-1979. And this is only the first step in introducing the new bacterial fertilizer to agricultural production.

The Belorussian SSR Communist Party Central Committee and the republic's government are devoting great attention to solving the problems of supplying rhizoturfene to the kolkhozes and sovkhoses. Not that long ago the Belorussian SSR Gosplan held a special conference during which problems associated with introducing the new bacterial fertilizer into agricultural production were discussed. Construction of a rhizoturfene plant has been started in Nesvizh; it will supply the valuable bacterial fertilizer to kolkhozes and sovkhoses in the republic and in the country.

This year there are plans for applying rhizoturfene to 240,000 hectares of legumes on the fields of Belorussia. In order that this task could be completed successfully, a number of kolkhozes and sovkhoses have organized training for specialists who will manage the work of applying the new bacterial fertilizer, and the necessary instructions and recommendations on



the procedures of sowing seeds treated with such fertilizer have been prepared for many farms.

The collective of the Belorussian SSR Academy of Sciences Institute of Nuclear Power Engineering adopted the pledge of sterilizing not less than 250,000 hectare portions of rhizoturfene substrate in January-March of this year. Around-the-clock work has been organized at the institute's gamma-radiation facility. The adopted pledge is being satisfied successfully. The preparation is being produced by the Nesvizh Feed Biomycin Plant, which delivers its products to our academy's Institute of Nuclear Power Engineering for sterilization.

[576-11004]

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## APPLICATION OF MINERAL FERTILIZERS IN CORN GROWING AND WAYS OF INCREASING THEIR EFFECTIVENESS

Moscow AGROKHIMIYA in Russian No 3, 1980 pp 141-151

GETMANETS, A. YE.

[Abstract] This is a review article. There can be no fixed system of applying fertilizers in constant proportions and mutual nitrogen-potassium-phosphorus ratios when it comes to corn growing, since in the USSR corn is grown on such extensive areas and in such varied types of soils and climates that the dosages and mutual ratios of fertilizers must be correspondingly adapted in each case. Specific types of corn hybrids used are another factor to be considered. The effectiveness of the fertilizers is also affected by the nature of the crop grown and harvested prior to the planting of corn. For example, fertilizers are more effective in increasing corn yields when applied to fields on which row crops (sugar beets, sunflowers) had previously been grown: this is due to the attendant greater--compared with stubble crops (winter wheat, barley)--depletion of nutrients from the soil, which is counteracted by the fertilizers. This is the case in years with adequate rainfall, whereas in dry years fertilizers are more effective when applied to fields on which previously stubble crops had been grown. Another way of enhancing the effectiveness of fertilizers is to apply them jointly with herbicides. In addition, the periods and techniques of fertilizer application must be adapted to the climatic and soil zones. Local application of fertilizers instead of their scattering application also increases corn yields. On carbonate soils it is important to apply zinc fertilizers (5-8 kg of zinc per hectare) in order to prevent corn-plant chlorosis. Nitrogenous fertilizers affect corn yields most markedly, and in this connection it is particularly important to apply inhibitors of the nitrification of ammonia such as dicyanamide and "AM." References 103: 100 Russian, 3 Western. [574-1386]

## EFFECT OF FERTILIZERS IN CROP ROTATION ON THE QUANTITY AND QUALITY OF FIELD CROP HARVESTS

Moscow AGROKHIMIYA in Russian No 3, 1980 pp 60-65 manuscript received 12 Mar 79

DZANAGOV, S. KH. and GIZOYEV, V. S., Gorskii Agricultural Institute, Ordzhonikidze

[Abstract] The effect of potassic, nitrogenous, and phosphoric fertilizers on the yields and quality of crops was investigated on an irrigated carbonate chernozem field under crop rotation (alfalfa, winter wheat, fodder, corn, grain corn, sunflower, winter wheat + alfalfa). The experiments were performed during the grain corn-sunflower-winter wheat part of crop rotation in the years 1974-1976. The optimal fertilizer combination turned out to be  $2N2P1K$  with a  $N:P_2O_5:K_2O$  ratio of 3.64:4.36:1. This resulted in increasing the harvesting yield by 106.7 centners per hectare, i.e., by 48.4%. The quality of the harvest then also was favorably affected, since the ratio of protein to starch increased. References 11 (Russian).  
[574-1386]

## UTILIZATION OF SOIL NITROGEN AND GRADUALLY INCREASED DOSAGE OF FERTILIZER BY VARIOUS CROPS: REPORT 2

Moscow AGROKHIMIYA in Russian No 3, 1980 pp 3-11 manuscript received 26 Dec 78

SHABAYEV, V. P., SOKOLOV, O. A. and KUDEYAROV, V. N., IAP, [Expansion Unknown] USSR Academy of Sciences, Pushchino, Moscow Oblast

[Abstract] The effect of doses of nitrogen fertilizer introduced under various crops and the fate of residual soil nitrogen were investigated. In the first year of the experiment nitrogen fertilizers were applied to gray forest soil on which were grown spring wheat, oats, barley, buckwheat, corn, and potatoes. The fertilizers were applied in the form of  $^{15}N$  labelled ammonium sulfate in the doses of 8, 16, and 32 mg per 100 g of soil. The degree of utilization of residual nitrogen of the fertilizers by subsequent crops was investigated by planting buckwheat and

spring wheat in the vessels in which the aforementioned crops had been grown in the first year. No effect of the nitrogen fertilizer on the subsequent buckwheat and spring wheat harvests was found, owing to the loss of virtually all the mobile mineral nitrogen of both the fertilizer and the soil during the fall-spring period. What is more, the application of the highest dose of fertilizer (32 mg/100 g soil) produced a negative effect owing to the attendant enhanced mineralization and loss of the soil nitrogen. References 12 (Russian). [574-1386]

UDC 631.84

EFFECT OF THE PERIODS OF APPLICATION OF NITROGENOUS FERTILIZERS AND A NITRIFICATION INHIBITOR ON THE DYNAMICS AND UPTAKE OF NUTRIENTS BY RICE PLANTS

Moscow AGROKHIMIYA in Russian No 3, 1980 pp 18-21 manuscript received 26 Feb 79

BAYZHIGITOV, K. B., SUTORMINA, N. V. and MOISEYEVA, I. G., Kazakh Scientific Research Institute of Agriculture, Alma-Atinskaya Oblast.

[Abstract] The effect of fractional application of nitrogenous fertilizers together with the N-serve nitrification inhibitor (in doses of 1% of the dose of nitrogen applied) was investigated on takyrl-like soils of the lower reaches of the Ili River in Kazakhstan. The fertilizers were applied in proportions of 30% prior to rice planting, 30% in the sprouting stage, and the remainder either in the tillering stage or in the leaf tube stage, and the content of nitrogen and phosphorus in the plant organs was subsequently analyzed. Compared with controls in which the entire annual dose of fertilizer was applied all at once prior to rice planting, and the nitrogen content of the panicle was 1.4%, fractional application of fertilizer resulted in a 1.9% nitrogen content of the panicle, thus apparently assuring an uninterrupted supply of nitrogen to the plants, which is a prerequisite for high harvests. Then, also, the total phosphorus content of the plants was increased, apparently owing to a more intense development of the root system of the nitrogen-fertilized variants and the attendant improvement in the mobilization of soil phosphates by the plants. The application of fertilizer in the late leaf tube stage is not as effective since, through the utilization of nitrogen is increased, thereby, the maturing of rice is delayed. References 8 (Russian). [574-1386]

## PHOSPHORUS BALANCE IN GRAIN-FALLOW ROTATION

Moscow AGROKHIMIYA in Russian No 3, 1980 pp 22-25 manuscript received  
5 Mar 79

VOLKOV, YE. D. and LIKHTENBERG, A. I., All-Union Scientific Research  
Institute of Grain Farming, Tselinogradskaya Oblast

[Abstract] In view of the low phosphorus content of the soils of Northern Kazakhstan, the yields of spring wheat there are still relatively low. Hence the effect of the application of phosphoric fertilizers was investigated on four fields constituting a grain-fallow rotation system (alternation of pure fallows, spring wheat, spring wheat, spring wheat). In all cases the application of phosphoric fertilizers resulted in an increase in the phosphorus uptake by the crop and in a marked increase in crop yields as well (from 22.8 kg/hectare in the absence of fertilizer to 31.2 kg/hectare upon application of fertilizer). Of the systems investigated, the best proved to consist in the application of P60 fertilizer to pure fallows along with annual application of P20 fertilizer to the planted rows of spring wheat. Then, not only do crop yields increase by 6.7-4.9 kg per hectare but also the residual phosphates in the soil increase by 52.0-54.3 kg/hectare, which is important to enhancing soil fertility in Northern Kazakhstan. References 10 (Russian). [574-1386]

## EFFECT OF SPARE APPLICATION OF PHOSPHORIC FERTILIZERS ON THE AGROCHEMICAL PROPERTIES OF DERN-PODZOLIC SOIL AND ON THE PRODUCTIVITY OF CROP ROTATION

Moscow AGROKHIMIYA in Russian No 3, 1980 pp 26-30 manuscript received  
2 Feb 79

SHEVCHENKO, L. A. and SIDORENKO, V. P., Poleskaya Experimental Station

[Abstract] The question of whether the application of a single dose of phosphoric fertilizers once every few years is more effective than their annual or fractional application was investigated for the case of the light dern-podzolic soils of the Polesian region of the Ukraine. The experiment was performed on a four-plot crop rotation area (silage lupine, winter rye, oats, potatoes), on applying phosphoric fertilizers (P90, P360, P720) annually, once every 4 years, and once every 8 years.



It was found that the application of a single dose of phosphoric fertilizers for a period of as many as 8 years ahead was as effective as annual application and did not adversely affect the quality of the crops. Then, however, compared with annual application, the content of mobile forms of phosphorus sharply increases and HCl-soluble phosphates migrate downward to a depth of 1 m. References 10 (Russian). [574-1386]

UDC 631.85:633.11:633.63

#### EFFECT OF PHOSPHORIC FERTILIZERS ON THE YIELDS AND QUALITY OF WINTER WHEAT AND SUGAR BEETS

Moscow AGRONOMICIA in Russian No 3, 1980 pp 31-34 manuscript received 12 Feb 79

PERISHAL, I. T. and GUDYM, V. I., Cherkasskaya Experimental Station

[Abstract] The benefits of phosphoric fertilizers were investigated for a zone with unstable humidification such as the Cherkasskaya Oblast. The fertilizers were applied prior to the plowing of a 100 sq m plot on which winter wheat and sugar beets were grown repeatedly over a 4 year period. The soils used were regraded cloddy-silty medium-loamy chernozems. Most of the phosphoric fertilizers used (granulated superphosphate, double superphosphate, ammophos, and phosphorite meal), and particularly double superphosphate resulted in a marked increase in the crop yields, but some, such as defluorinated phosphate and phosphate slag, were relatively ineffective apparently owing to their low water-solubility. On the other hand, phosphate slag resulted in an increased sugar content of beets, and defluorinated phosphate resulted in a higher amount of gluten in the grain of winter wheat. There was no consistent pattern, as the effectiveness of the different phosphoric fertilizers varied from year to year depending on precipitation, air temperature, and the amount of moisture in the soil. On the whole, however, as revealed by cost-analysis, double superphosphate, ammophos, and granulated superphosphate are best suited for application to regraded chernozem soils used to grow winter wheat and sugar beets in Right-Bank Ukraine (forest-steppe region). References 8 (Russian). [574-1386]

# INVESTIGATION OF PHOSPHORUS AND POTASSIUM NUTRITION OF THE POTATO BY THE TAGGED ATOM METHOD UPON APPLICATION OF INCREASING DOSES OF FERTILIZERS

Moscow AGROKHIMIYA in Russian No 3, 1980 pp 35-43 manuscript received 11 Mar 79

IVANOV, S. N. and LAPA, V. V., Belorussian Scientific Research Institute of Soil Science and Agrochemistry, Minsk

[Abstract] The optimal dosages and ratio between phosphorus and potassium fertilizers with respect to the potato crop were investigated for potatoes of the Temp variety grown on lowland moor-peat soil, using  $^{32}\text{P}$  and  $^{83}\text{Rb}$  as markers. Plant samples were collected throughout the vegetation season to determine their content of total and radioactive phosphorus as well as of total potassium and rubidium-85. It was established that the uptake of potassium and phosphorus from fertilizers into the potato tubers reached its peak during the stage of maximum weight increment of the tubers, i.e., starting with the flowering stage and ending with the commencement of the desiccation of the leaves. As the levels of phosphorus and potassium nutrition increase, the uptake of these elements from the fertilizers by the plants increases, while their uptake from the soil decreases. Optimal growth of the potato plants is assured when the ratio between phosphorus and potassium in the fertilizers applied is approximately 1:3, i.e., about 230 mg  $\text{P}_2\text{O}_5$  and 800 mg  $\text{K}_2\text{O}$  per kg soil. Figures 6; references 6 (Russian).

[574-1386]

# RESIDUAL EFFECTS OF POLYMERIC SOIL AGGREGATING AGENTS

Moscow AGROKHIMIYA in Russian No 3, 1980 pp 93-96 manuscript received 11 Dec 78

POLYAKOVA, YE. YU., Ukrainian Scientific Research Institute for the Protection of Soils Against Erosion, Voroshilovgrad.

[Abstract] The residual effect of polyacrylamide (PAA) and hydrolyzed polyacrylonitrile (K-4) on the erosion resistance of underdeveloped sandy durn soils was investigated in field experiments. As regards PAA, the largest amount of water-resistant aggregates was observed upon the application of 200 kg of the polymer per hectare, i.e., of the maximum

dose in the experiment. By contrast, only one-half as much K-4 (100 kg per hectare) was needed to produce the same effect, even after 4 years from the date of its application. Similarly, K-4 proved to be superior to PAA in intensifying the biological activity of the soil and enhancing soil fertility and crop yields. In the course of their sequelae, both polymers acted like good-quality nitrogenous fertilizers, apparently because the nitrogen they contain exists in a form readily assimilable by crops. Thus, while both polymers act as soil aggregating agents and fertilizers, the use of PAA on light mechanical soils should be restricted, while the use of Preparation K-4 should be widened. References 3 (Russian). (574-1386)

UDC 543.2

## USE OF PULSED NMR SPECTROSCOPY FOR MASS ANALYSES OF HIGHLY OLEAGINOUS CROPS DURING THEIR QUALITY ASSESSMENT

Moscow AGROKHIMIYA in Russian No 3, 1980 pp 117-124 manuscript received 27 Nov 78

KRISHCHENKO, V. P. and ZHIGULEV, K. K., TAIKAO [expansion unknown]

[Abstract] A pulsed NMR spectroscopic technique based on recording the difference in induced signal following the excitation of protons by a 90 degree pulse, was experimentally used to determine the fat content of the seeds of highly oleaginous crops such as the sunflower, as well as of soybeans. Preliminary investigation revealed that the accuracy of the tests is enhanced by first pulverizing the seeds, since the rms error of measurements is then as low as 0.10-0.27. This technique is particularly promising if the moisture content of the analyzed samples varies within narrow limits ( $\pm 2\%$ ) and it reduces analysis time by one order of magnitude. (The net time of the assay of fat content by means of the Minispek p-20 relaxometer is 5 min). The results are sufficiently representative, since the difference between discrete successive measurements of the same sample was not more than 1 abs.%. Figures 2; references 21: 5 Russian, 16 Western. [574-1386]

**AROMA OF HAM PRODUCTS AS A FUNCTION OF THE DEGREE OF AUTOLYSIS, PICKLING TIME AND HEAT-TREATMENT CONDITIONS**

Krasnodar IZVESTIYA VUZov: PISHCHEVAYA TEKHNLOGIYA in Russian No 1(134), 1980 pp 31-34 manuscript received 18 Apr 79

VORONTSOV, A. A. and BOL'SHAKOV, A. S., Department of Biochemistry; Department of Technology of Meat and Meat Products, Kiev Technological Institute of the Food Industry; Moscow Technological Institute of the Meat and Dairy Industry

[Abstract] The aroma of ham products is produced by complex interaction of a large number of volatile components. In particular, sulfur-containing compounds with low threshold concentrations and a sharp odor play a large part in the aroma of ham. In this paper an investigation was made of the dynamics of hydrogen sulfide, mercaptans, diethyl and dimethyl sulfides in the production of pressed ham from fresh meat and from meat refrigerated for two days at 275-277 K with different pickling times. The different techniques used for preparing the ham are described. The results show that high concentrations of thio compounds improve the aroma of the finished product. This is confirmed by tasters' evaluation: the best marks were given to ham with the highest content of sulfur compounds. Taste and aroma were judged to be best on ham prepared from refrigerated meat held in brine for 21 days with heat treatment in a steam-air mixture at 385 K until a temperature of 345 K was reached in the center of the ham. The product prepared from fresh meat without additives or mechanical treatment contained lower amounts of thio compounds and was given lower marks by tasters. Figure 1; references 10: 5 Russian, 5 Western. [573-6610]



## OXIDATION OF MYOGLOBIN AND LIPIDS IN DEFROSTED WHALE MEAT

Krasnodar IZVESTIYA VUZov: PISHCHEVAYA TEKHNLOGIYA in Russian No 1(134), 1980 pp 13-15 manuscript received 29 Dec 78

DEDYUKHINA, V. P., SAMBUROVA, G. N., GALUN, L. A., LENTSOVA, L. V. and KALUGINA, S. A., Department of the Science of Foodstuff Commodities; Department of Organic Chemistry, Far Eastern Institute of Soviet Trade

[Abstract] The process of thawing frozen whale meat for use in sausage has a decisive effect on quality. In this paper the authors explain the relation between accumulation of metmyoglobin and oxidation of lipids during defrosting and short-term storage of whale meat. The meat of a sei whale was prepared as blocks weighing 39 kg with a 1 mm ice coating packed in four-layer kraft paper bags with polyethylene liner. Two defrosting schedules were studied: rapid defrosting at 18-20°C for 18 hours, and slow defrosting at 3-6°C for 48 hours. The thawed meat was stored for 5 days at 3-6°C. A spectrophotometric technique was used for determining pigments of myoglobin (Mb), Metmyoglobin (MMb) and oxymyoglobin (MbO<sub>2</sub>). It was found that frozen whale meat contains about 37% Mb, 60% MbO<sub>2</sub> and 4% MMb as calculated for the total amount of pigment. The sliced meat is pink. The meat thawed at 18-20°C retains a pink-red color at a temperature of -4°C inside the block. When the temperature of the block has risen to -1°C, the oxymyoglobin content decreases, and the content of metmyoglobin and myoglobin increases somewhat, intensifying the red color. With slow thawing, the meat retains the pink-red color until the temperature inside the block has reached -1°C. In the case of rapid defrosting, the content of metmyoglobin increases to an average of 45% on the second day of storage. With increasing metmyoglobin content, the color of the meat changes to brown and nearly black, which is observed on the third to fifth day of storage. Darkening is accompanied by an accumulation of products of oxidation of intramuscular lipids. In meat thawed on a slow schedule an approximately equal ratio of myoglobin and oxymyoglobin is retained up to the third day of storage. Although metmyoglobin accumulates, the meat retains its red color. Then it begins to darken, and becomes dark brown by the fifth day of storage. The process of accumulation of products of lipid oxidation is less intense in slow-thawed whale meat. Figures 2; references 10: 5 Russian, 5 Western. [573-6610]

GRANULATING FEED CONCENTRATE IN CYLINDRICAL DRAWPLATE CHANNELS WITH  
CONTINUOUS PRESSING

Krasnodar IZVESTIYA VUZov: PISHCHEVAYA TEKHNLOGIYA in Russian No 1(134),  
1980 pp 67-71 manuscript received 29 Jan 79

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[Abstract] The paper deals with the problems of steady-state continuous pressing of precompressed feed concentrate in drawplates with cylindrical channels. An analysis is made of the motion of the material in a cylindrical channel of given diameter and length in the cylindrical coordinate system with origin at the center of the channel in the plane of the output cross section. The body forces that arise during motion of the concentrate are disregarded, and the differential equation for stresses in the material is solved, assuming that the feed concentrate is a plastic body with constant yield stress. Formulas are derived for calculating the stress distribution in the drawplate with continuous pressing when dimensions are known and the yield stress of the feed concentrate is a known function of axial normal stress. These same formulas can be used to determine the required length of the drawplate when variable behavior of yield stress is known and the inlet pressure to the channel is predetermined. If the stresses in the feed are measured at several cross sections of the channel, the proposed formulas can be used to determine the way that the yield stress depends on hydrostatic pressure. Figure 1; references 2 (Russian).  
[573-6610]

## DETERMINATION OF THE MOISTURE CONTENT OF A CARAMEL BATCH BY THE METHOD OF PROTON MAGNETIC RESONANCE

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[Abstract] Conventional methods of testing a batch of caramel for moisture content involve weighing a specimen, and are not applicable to monitoring of the continuous process. The authors propose a method based on proton magnetic resonance that is based on a technique devised previously for using nuclear magnetic resonance techniques for express or continuous determination of moisture and fats in some agricultural products. Since the proton magnetic resonance signals of caramel are of the order of microseconds in duration, moisture determination is based on the decay of free induction after a  $90^\circ$  pulse as an indicator of the effect that moisture has on the shape of PMR signals and the time of spin-spin relaxation of protons. The results show that caramel is a unified polymeric amorphous system in which the molecular mobility and time of spin-spin relaxation of protons are completely determined by moisture content. A formula is given for determination of moisture content from the amplitude ratio of free induction decay signals measured at two instants after the trailing edge of a  $90^\circ$  pulse. Total time of analysis by the proposed method is no more than 5 minutes, and no weighing or other preparation of specimens is required. References 9 (Russian). [573-6610]

## PRODUCTION OF IMERETINSKIY CHEESE WITH AMILORIZIN MICROBIAL PREPARATION G20Kh

Krasnodar IZVESTIYA VUZov: PISHCHEVAYA TEKHOLOGIYA in Russian No 1(134), 1980 pp 35-37 manuscript received 21 Jul 79

ZVAGINTSEV, V. I., KURASHVILI, R. F., OVCHINNIKOV, A. D. and GORETOVA, O. V., Department of Technology of Milk and Dairy Products, Kemerovo Technological Institute of the Food Industry

[Abstract] Proteases of microbial origin can be used to cover the shortage of rennin in cheese making. Most proteases coagulate milk and break down the curd. In most cases when the curd is not broken down, the finished cheese treated with a microbial protease has impaired taste, smell and consistency. These changes occur in natural cheeses and can be attributed to more or less prolonged action of the microbial protease on casein during ripening. It might be feasible to use such proteases in making brine cheeses. Imeretinskiy cheese undergoes almost no ripening, and high concentrations of salt might actively inhibit proteolytic enzymes. This possibility was checked out by study of Imeretinskiy cheese production using Amilorizin G20Kh microbial enzyme with amylolytic and pronounced milk coagulating properties. It was found that the moisture, fat, lactose and dry product contents were nearly the same for Imeretinskiy cheese made with rennin and with Amilorizin G20Kh microbial protease. The nonprotein and amino nitrogen was higher in the experimental cheese than in the control, indicating more active proteolytic processes with the microbial enzyme. The experimental cheese has a considerably higher content of phenylalanine, leucine, valine and aspartic acid. There is also a noticeable increase in acetate. Despite the chemical differences, the experimental and control cheeses were evaluated identically by tasters. Figure 1; references 5: 3 Russian, 2 Western. [573-6610]

OPTIMIZING A TWO-STAGE PROCESS OF GROWING NUTRIENT YEAST

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[Abstract] One way to improve effectiveness of growing yeast on undiluted alkali with high content of reducing substances is to convert from a single-stage growth process to a two-stage process. The authors propose a method of determining the optimum conditions of growing yeast in a two-stage system based on mathematical modeling and dynamic programming. The results show that even when the detriment to mass exchange under industrial conditions is considered, a two-stage process can increase the yield of yeast by 12-18% with optimum distribution of reducing substances between stages and optimum salt and temperature conditions. Figure 1; references 3 (Russian).  
[573-6610]



## RESEARCH ON ARTIFICIAL MUTAGENESIS IN AGRICULTURE DESCRIBED

Moscow IZVESTIYA in Russian 2 Apr 80 p 3

[Article by K. Sytnik, academician of the Ukrainian SSR Academy of Sciences, vice-president of the Ukrainian SSR Academy of Sciences, Kiev: "Plants That Did Not Exist"]

[Text] Today one will hardly take it upon himself to forecast what tomorrow's agricultural technology will be. Probably plants will begin to utilize solar energy much more fully. Perhaps they will take the nitrogen they need directly from the air. Perhaps it will be possible to transform plants into milk and meat, bypassing... the cow stage. After all, nature and science did not impose fundamental bans on something like this. Therefore, the opportunities for scientific research are unusually wide. For the time being only the first steps have been taken, but there are also the first gratifying results. I have in mind the use of the method of experimental mutagenesis in agricultural practice.

For example, how are new plant varieties now bred? Usually, for the breeder this work begins with a search among plants, which are already available, of specimens that surpass members of their families in the yield, content of one of the substances useful for man, ripening time and so forth. Such plants standing out against the general background are called mutants. They owe their nonstandard nature to spontaneous mutagenesis. The most common factors, that is, an abrupt change in temperature, entry of some chemical compounds into the field with rain and change in the intensity of ultraviolet radiation, can affect the hereditary apparatus of plants (and the characteristics of their progeny). In other words, beginning the breeding of a new variety, the breeder turns to the set of variants that nature prepared for him.

In the last few years, however, this source has no longer satisfied breeders. Nature does not create mutants often and their properties do not always meet the needs of practice.

Therefore, artificial mutagenesis, which makes it possible to create mutants in a laboratory, has now been developed intensively. The advances of nuclear physics, which made radiation sources accessible, as well as the discovery of highly active new chemical mutagens, contributed to this.

How do specialists now affect the hereditary apparatus of plants? Ionizing radiation, some classes of chemical compounds, intermittent concentrated sunlight and so forth have become such factors of effect on seeds, sprouts, pollen and other plant organs under laboratory conditions. This, essentially first, stage in the production of mutations required the common efforts of physicists, chemists and geneticists.

In the Ukrainian Academy of Sciences the institutes of nuclear research, problems of materials technology and physical chemistry undertook the work on the effect of ionizing radiation and intermittent concentrated sunlight. They have created special devices and annually irradiate the breeding material of many scientific institutions in the republic.

The Division of Experimental Mutagenesis of the Institute of Molecular Biology and Genetics of the Ukrainian SSR Academy of Sciences is the center of research on the effect of various chemical substances on plant cells. Mutagens and new classes of compounds, which have been known for a long time and were first developed by I. Rapoport, corresponding member of the USSR Academy of Sciences, from the Institute of Chemical Physics of the USSR Academy of Sciences, were also tested there.

All these substances are noted for the fact that they are capable of penetrating into the living cell, reaching the chromosomes and modifying their individual sections. Of course, mutagens also affect other cell components, but what happens with chromosomes is especially important for geneticists, because disturbances in their structure are transmitted to the progeny.

The use of highly active mutagens enables researchers to raise the level of spontaneous mutability sharply—1,000-fold and more—and to obtain a vast diversity of original plant forms.

This is a very important, but only the first, stage in the development of a new variety. Direct work with plants grown from seeds, which were subjected to a mutagenic effect, is the second. The efforts of geneticists, breeders, phytopathologists and other specialists are unified here. Usually, work lasts several years and the most suitable specimens are selected. They are sown under the most different conditions, including against an infectious background, that is, on plots known to be infected with diseases. The most resistant, hardy and productive plants are selected for further tests and for the determination of the number of plants to be bred.

At the beginning of the article, I discussed the possibilities of using the method of experimental mutagenesis for today's agricultural technology, primarily in grain farming. The following is the most recent example.

Using the method of experimental mutagenesis, the Institute of Molecular Biology and Genetics of the Ukrainian SSR Academy of Sciences together with the Cherkassy State Agricultural Experimental Station, the Ukrainian Scientific Research Institute of Farming, the Kuban' Experimental Station of the All-Union Institute of Plant Growing and other institutions obtained new hybrids of fodder corn. They are noted for early ripening, good productivity and resistance to unfavorable environmental factors. The potential yield of the grain of these hybrids is 70 to 106 quintals per hectare. Resistance to lodging and suitability for mechanized harvesting are very important qualities of the new hybrids.

However, new varieties of agricultural plants can also be developed differently, without hybridization—by a direct selection of the most suitable specimens obtained after treatment with mutagens. It is precisely by this method that the Institute of Molecular Biology and Genetics of the Ukrainian SSR Academy of Sciences together with the Cherkassy Agricultural Experimental Station and the Ukrainian Agricultural Academy developed the new Kiyanka wheat variety.

Kiyanka was obtained by means of diethyl sulfate. Wheat seeds of the Mironovskaya Yubileynaya variety were treated with this mutagen. Then they were sown. Changes were not detected in the first generation, because most factors are controlled by dominant genes. Children resemble their parents. Individual low-growing plants appeared on the plot during subsequent generations. These mutants became the ancestors of this variety.

For several years seeds were reproduced and a direct selection was made. Finally, the variety was obtained. Kiyanka is a semidwarf wheat noted for early ripening and enviable resistance to lodging. During 3 years of tests characterized by heavy lodging of grain, Kiyanka remained standing on all farms.

It is a highly productive variety. A grain harvest of 70 to 86 quintals per hectare was obtained in 17 different spots in the Soviet Union, which points to the high ecological plasticity of this variety. Under production conditions in 1979 the harvest of Kiyanka on 24 farms in eight oblasts in the Ukraine totaled 43.2 quintals per hectare, which was almost 5 quintals more than the harvest of regionalized standards.

For an accelerated introduction of this variety for the 1980 harvest, initial seed breeding links with an annual output of elite seeds of 1,000 tons were established in three scientific research institutions in Kiyevskaya Oblast. More than 12,000 quintals of seeds meeting quality requirements have already been grown on the oblast farms. For the 1980 harvest Kiyanka seeds were allocated to 80 farms in Kiyevskaya, Ivano-Frankovskaya, Chernovitskaya, Ternopol'skaya, Dnepropetrovskaya and other oblasts in the Ukraine, on which reassuring results were obtained on the basis of 2-year data of state and production tests.

Of course, the examples cited above do not exhaust the list of successful uses of the method of experimental mutagenesis in the agricultural sphere. We are only at the beginning of the scientific research aimed at the development of new genetic methods of plant breeding, the need for the development of which was stressed in the decisions of the 25th CPSU Congress. It is important to note that these methods very quickly become available for the daily practice of production collectives.

Moreover, the traditional bridges connecting science with production are gradually transformed into a technological conveyor, where the speed of movement of new ideas to the practice of general use is different and higher. For example, the Institute of Molecular Biology and Genetics undertook all the work connected with the fulfillment of the first stage in the production of mutations. This greatly facilitates the work of breeding institutions on the introduction of mutations, because they immediately obtain plants of the second generation. With such an organization of scientific research the method of experimental mutagenesis can be introduced in any breeding institution without special additional expenditures. It easily "joins" the generally accepted scheme of the breeding process without changing it.

This means that the methods of genetics become available to many institutions, expanding the horizon for science and creating real prospects both for today's and tomorrow's practice.

[575-11,439]

11,439

CBO: 1840



HERBICIDAL ACTIVITY OF SUBSTANCE CONTAINING THE TRICHLOROALLYL GROUP.  
REPORT 2: TRICHLOROALLYL ESTERS OF ALIPHATIC CARBOXYLIC AND HALOCARBOXYLIC  
ACIDS

Moscow AGROKHIMIYA in Russian No 3, 1980 pp 97-101 manuscript received  
27 Mar 79

SHCHEGLOV, YU. V. (deceased), NIKISHIN, G. I., KOZINA, L. S., DYUSENOV,  
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[Abstract] The herbicidal activity of 33 newly synthesized trichloroallyl  
esters of aliphatic monocarboxylic acids (common formula:  $\text{Cl}_2\text{C} = \text{CClCH}$   
(R')OCOR) was investigated in field experiments by applying them in doses  
of 10 kg/hectare during the 1968-1976 period. Of the substances investi-  
gated, the esters of trichloroacetic and trifluoroacetic acids proved to  
be the most effective. The other esters tested, while less active, dis-  
play a different selectivity of action. These findings indicate a need  
for broad field tests of, in particular, trichloroallyl alcohol and its  
most active esters--acetate and trichloroacetate to protect tobacco,  
potatoes, cucurbitaceous crops, umbellate crops, and buckwheat against  
such weeds as grass, goosefoot, cruciferae, spiderwort, and thistles.  
References 7 (Russian).  
[574-1386]

UDC 631.445.4:631.433.3:631.46

EFFECT OF THE AGRICULTURAL UTILIZATION OF THE CHERNOZEMS ON THEIR  
BIOLOGICAL PROPERTIES

Moscow AGROKHIMIYA in Russian No 3, 1980 pp 86-92 manuscript received  
9 Mar 78

YEGOROV, V. P. and KRIVONOS, L. A., Kurgan Agricultural Institute

[Abstract] Research into the biological activity of chernozem soils in  
the Transurals indicates that the agricultural utilization of these soils  
affects their biological properties depending on the level of their  
cultivation. Compared with virgin-soil chernozems, the cultivated  
chernozems display a higher and less variable biological activity and a  
thicker biogenously active layer.  $\text{CO}_2$  production (soil respiration rate)



and nitrification capacity are favorably affected also. Of the tilling techniques influencing biological activity of the chernozems, the upturning of soil to a depth of 22 cm, the Mal'tsev method of plowing without upturning, and flat-plowshare loosening to a depth of 25-27 cm are the most effective, even without fertilizers. But fertilizers too can intensify biological processes in the soil, provided that they are applied by such techniques e.g., as direct placement in the soil. Then crop yields also significantly increase. References 10 (Russian). [574-1386]

UDC 631.563.8:633.18

#### EFFECT OF PROPIONIC ACID ON CHEMICAL COMPOSITION AND BIOCHEMICAL PROPERTIES OF RICE GRAIN WITH ELEVATED MOISTURE CONTENT

Krasnodar IZVESTIYA VUZov: PISHCHEVAYA TEKHNLOGIYA in Russian No 1(134), 1980 pp 25-27 manuscript received 14 Nov 79

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[Abstract] The nutritional value of rice readily undergoes irreversible changes when storage conditions are unfavorable. This is a study of the way that propionic acid as an aerosol affects the chemical composition and biochemical properties of freshly harvested rice with moisture content of 20.5% stored in an elevator. The tests were done with two controls: I--freshly harvested rice dried to the stable state before storage; II--rice with moisture content of 20% stored without preservative. The total, non-protein nitrogen was determined in the experimental and control rice specimens. The content of starch, reduced sugars, and activity of amylolytic and proteolytic enzymes were also determined. It was learned that the total activity of amylases in rice grain with preservative decreased after 60 days by 30% compared with the dried control (I), and was half the value of the raw control (II) subjected to self-heating for 15 days. The activity of proteolytic enzymes in the grain with preservative was somewhat higher than in the dried control (I), but considerably lower than in the untreated raw control (II). The amount of starch and protein is not significantly affected by propionic acid treatment. On the other hand, the fractional content of protein changed considerably during storage of untreated raw rice. Thus treatment with propionic acid as a preservative has an inactivating effect on amylolytic and proteolytic enzymes, which is conducive to retention of the initial quality of rice stored without drying. References 7 (Russian). [573-6610]

## EFFECT THAT ELEVATED CONCENTRATIONS OF CARBON DIOXIDE HAVE ON THE HYDROLASE ACTIVITY OF MALT DURING GERMINATION

Krasnodar IZVESTIYA VUZov: PISHCHEVAYA TEKHOLOGIYA in Russian No 1(134), 1980 pp 28-30 manuscript received 20 Dec 78

BALENKO, T. L., DOMARETSKIY, V. A. and VELIKAYA, YE. I., Department of Technology of the Fermentation Industries, Kiev Technological Institute of the Food Industry

[Abstract] This is a study of the action of elevated CO<sub>2</sub> content on the activity of proteolytic and amylolytic enzymes during germination of malt. The experiments were done with the Nutans-244 variety of barley, having 14.32% protein content. After steeping, the malt was divided into a control specimen allowed to germinate under ordinary conditions, and a test specimen that was placed in a hermetic chamber in which the atmosphere was saturated with carbon dioxide to the necessary concentration. All series of experiments were done under conditions that maximize proteolytic activity and ensure complete accumulation of amine nitrogen. The concentration of CO<sub>2</sub> and malting time at the given concentration were varied. It was found that a CO<sub>2</sub> content of more than 30% in the atmosphere during malting inhibits proteolytic enzyme activity. Holding the malting grain in a CO<sub>2</sub> atmosphere without oxygen for the first two days does not inactivate amylolytic and proteolytic enzymes. Rootlet growth is retarded by CO<sub>2</sub> content in excess of 30%. It is concluded that the CO<sub>2</sub> concentration in air should not be increased beyond 30% until proteolytic enzymes have reached maximum activity. References 7: 6 Russian, 1 Western. [573-6610]

UDC 633.19.002.611:547.953

## PHOSPHOLIPIDS OF TRITICALE

Krasnodar IZVESTIYA VUZov: PISHCHEVAYA TEKHOLOGIYA in Russian No 1(134), 1980 pp 130-131 manuscript received 19 Mar 79

ALAM, Anis, NECHAYEV, A. P., YEREMENKO, T. V. and DORONINA, O. D., Department of Organic Chemistry, Moscow Order of Labor's Red Banner Technological Institute of the Food Industry

[Abstract] An investigation is made of phospholipids of the Soviet interspecies hybrid triticale AD 206. The content of total phosphorus in lipids of the grain was determined by a colorimetric technique designed for determination of from 0.5 to 4 µg of phosphorus. The results showed

that triticale AD 206 contains 7.8% total phosphorus in the lipids. Out of five fractions of phospholipids isolated from the grain by thin-layer chromatography, the largest is the phosphatidyl choline fraction, and the smallest is the stearin fraction. In all gas-liquid chromatography analyses of phospholipid fractions, most belong to the linoleic acid group, and fewest belong to the stearic acid group. References 7: 3 Russian, 4 Western.  
[573-6610]

IRREVERSIBLE SORPTION OF  $^{14}\text{C}$ -TAGGED CARBON DIOXIDE BY SOILS AS A FUNCTION OF VARIOUS FACTORS

Moscow AGROKHIMIYA in Russian No 3, 1980 pp 125-130 manuscript received 28 Feb 79

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[Abstract] The irreversible sorption of  $\text{C}^*\text{O}_2$  by coarse-loamy soil was investigated, by the  $^{14}\text{C}$  tagging method, as a function of such factors as the concentration of  $\text{C}^*\text{O}_2$  in the gaseous phase, soil moisture, and ambient air temperature. The dependence of that sorption on  $\text{C}^*\text{O}_2$  concentration in the gaseous phase was investigated at  $18^\circ\text{C}$ , keeping soil specimens for 2.5 days in a  $\text{C}^*\text{O}_2$  chamber and varying the tagged  $\text{C}^*\text{O}_2$  concentration from 0.06 to 45 vol.%. The results were plotted in the form of a convex curve with the "saturation" region being reached at  $\text{C}^*\text{O}_2$  concentrations of 30-45% (irreversible sorption reaching about 25 mg  $\text{C}^*\text{O}_2$  per 100 g of soil). The effect of soil moisture was also investigated and it was found that irreversible sorption increases in direct proportion to the moisture content of the soil. Compared with absolutely dry soil, for 100% wet soil the irreversible sorption of  $\text{C}^*\text{O}_2$  increased by a factor of 13 and amounted to 12 mg/100 g soil, since wet soil retains the irreversibly adsorbed  $\text{C}^*\text{O}_2$  more firmly than does dry soil. As for the temperature dependence of the sorption, it is described by an S-shaped curve: the irreversible sorption of  $\text{C}^*\text{O}_2$  ceases at  $-10^\circ\text{C}$  and reaches its optimum at  $+30^\circ\text{C}$ . The dependence of the sorption on soil types was also investigated, and it was found that specimens of dark-gray medium-loamy soil from Moscow Oblast and of a typical medium-loamy chernozem from the Kursk Natural Preserve displayed basically the same kinetics of irreversible sorption of  $\text{C}^*\text{O}_2$  as did the dern-podzolic medium-loam soil. The fact that the chernozem specimens were only one-third as active in this respect, but still lay within the same order of magnitude, shows that the humus content of soils does not directly affect their irreversible sorption of  $\text{C}^*\text{O}_2$ . Figures 4; references 4 (Russian). [574-1386]

## STATE AND PERSPECTIVES OF RESEARCH INTO THE AGROCHEMISTRY OF RADIONUCLIDES

Moscow AGROKHIMIYA in Russian No 3, 1980 pp 133-140

YUDINTSEVA, YE. V.

[Abstract] This is a review article. Agrochemistry of radionuclides is a scientific discipline that was first founded more than three decades ago at the Timiryazev Agricultural Academy. It deals with the interaction of nuclides and soils as well as the development of measures to minimize the content of radioactive substances in harvests. A major finding has been that the different soil types affect differently the nature of the migration of radioactive fallout in the biological cycle depending on their sorbability of microquantities of radionuclides. Heavier soils retain radioactive fission products--especially  $^{90}\text{Sr}$  and  $^{137}\text{Cs}$ --more firmly than do lighter soils. The mineralogical composition of soils also is a factor: minerals of the montmorillonite group--ascanite, gumbrine, and certain micas and hydromicas--display a special capacity for  $^{137}\text{Cs}$  retention. Correspondingly,  $^{90}\text{Sr}$  and  $^{137}\text{Cs}$  buildup in plants grown on different soil types differs markedly. The buildup of  $^{90}\text{Sr}$  in crops harvested from dern-podzolic sandy loam soils may differ by a factor of as much as 50-70 from their buildup in crops harvested from chernozem soils, and for  $^{137}\text{Cs}$  this difference may reach 100 fold. Biological features of crops also are a factor: crops with a high calcium concentration usually display a high  $^{90}\text{Sr}$  buildup, and crops with a high potassium concentration, a high  $^{137}\text{Cs}$  buildup, although more recent research has produced converse results. By now, several techniques for predicting and reducing the contamination of crops by radionuclides have been developed. E.g., it has been established that neutralization of soil acidity by means of liming can reduce in half or by two-thirds the buildup of radionuclides in crops. Manuring is another effective countermeasure, as is the application of mineral fertilizers, though in the latter case the effect achieved depends on the fertilizer type and the soil. Another countermeasure is deep plowing. The growth of the atomic power industry and the spreading use of chemicals in agriculture necessitate research into the effect of uranium, thorium, and radium on the soil-crop system, while the advances in industrialization require investigating the effect of pollution by heavy metals on the soil-vegetation cover. This in its turn necessitates using radioactive isotopes as an investigative technique. References 27 (Russian). [574-1386]

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